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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/937,004	MIMURA ET AL.	
	Examiner	Art Unit	
	Kevin Siangchin	2623	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-5 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-5 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 22 May 2002 is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☒ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 08/28/02, 09/11/02, 01/12/04.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Detailed Action

Preliminary Amendments

1. The preliminary amendment, filed the 5th of March 2003, has been made of record. Claims 1-5 have been amended accordingly.

Foreign Priority

2. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Drawings

Objections

3. The drawings are objected to because of the following:

   a. In Fig. 1, the reference number corresponding to the INTERFACE of the READER/WRITER **110** should be replaced with typed text.

   b. The candidate points are not clearly depicted in Fig. 8. The Applicant may be better served by depicting these as white/empty circles (e.g. O) or gray circles, as opposed to black dots.

c. The angle **830** (cf. page 21, paragraph[1] 1 of the Specification) is not clearly depicted in Fig. 8. The Applicant may be better served using a shade of gray to indicate this angle

d. The various arrows emanating from the corresponding reference numbers become obfuscated in the blackness of the fingerprint pattern shown in Fig. 8. Again, the Applicant may be better served using a shade of gray for these.

e. The normal vector **805** (page 18, line 5 of the Specification) is not shown in Fig. 8. Arrows, which may be indicative of vectors, are shown in Fig. 8, but these are barely visible. Again, the Applicant may be better served using a shade of gray for these.

Note that Fig. 8 is critical to the understanding of the Applicant's invention and should be made as clear as possible. For example, it would be difficult to conceive of the Applicant's definition of curvature without Fig. 8. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

Objections: Title of the Invention

4. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

5. The current title also implies some detection of whether or not the subject is living, or, at least, implies some requirement that the subject is living. No such detection is disclosed or claimed, nor is there an explicit requirement that the subject be living. The Applicant's claimed invention analyzes the structure of the input fingerprint and authenticates the subject based on the result of that analysis. Although it is perhaps preferable that

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1 When referring to paragraphs in the cited references, the convention followed here is that the paragraph number is assigned to paragraphs of a given column (if applicable), section, or page, sequentially, beginning with the first full paragraph. Paragraphs that carry over to other columns or pages will be referred to as the last paragraph of the column or page in which they began.

the fingerprint be from a living subject, the Applicant's claimed invention could function even on the fingerprint of non-living subject, assuming an intact fingerprint could be presented.

Objections

6. The disclosure is objected to because of the following informalities:

a. Paragraph 3 on page 24 of the Specification appears to contradict the last paragraph on page 22. According to the last paragraph on page 22 of the Specification:

> First of all, a plurality of points 2510 are set on a straight line passing through the point 2505. Next, all the absolute values of the differences between the luminance of the point 2505 and the luminance of the individual points 2510 are added. These operations are performed in a plurality of directions, and it is decided that the direction of the smallest value matches the ridge direction.

That is, the direction of the ridge passing through the point **2505** is the direction which exhibits the least sum of absolute differences of luminance (SADL). Paragraph 3 on page 24, on the other hand, states that:

> ...the angle having the minimum angle out of the evaluated values assigned to the individual angles (S2635) is calculated. The angle having the minimum value determines the direction of the ridge at the standard point.

This implies that the direction having the minimum angle with respect to the "evaluated values assigned to the individual angles" is chosen as the direction of the ridge. This is clearly contrary to the excerpt from the last paragraph on page 22. Moreover, this proposition makes little sense. The angle of the ridge can take on a variety of values, in including very sharp or even vertical orientations. The angle of a ridge need not be constrained to small or minimal angles. Having said that, if more than one direction were to exhibit the same least SADL, then choosing the one with the smallest angle would be a legitimate choice. It is not clear whether or not this was meant in paragraph 3 on page 24 of the Specification.

b. According to sentence 1 on page 21 of the Specification, "curvature may be determined by any method, but the cosine of the angle made between the adjoining candidate points is defined as curvature". To illustrate this, the Applicant refers to angle **830** of Fig. 8. However, if one inspects Fig. 8 (very closely), it appears angle **830** is the angle between adjoining normal vectors (e.g., the (barely visible) normal vectors drawn between candidate points), *not* adjoining candidate points.

In particular, if candidate point **820** is the vertex of angle **830**, let the neighboring candidate point to the left be **819** and the neighboring candidate point to the right be **821**. Then the angle **820** is the angle between the normal vector, which spans **819** and **820,** and the normal vector, which spans **820** and **821**. Also, note that neither of the candidate points **819**, **820**, and **821** are adjoining, whereas, the normal vectors that span them are. Thus, Fig. 8 (when closely scrutinized) seems to illustrate an angle made between the adjoining normal vectors. In keeping with Fig. 8, it will be assumed in this document that the Applicant intended to define curvature as the cosine of the angle made between adjoining normal vectors.

Appropriate correction is required.

Claims

Objections

7. Claims 1, 3, and 5 are objected to because of informalities.

8. *The following is in regard to Claim 1.* In Claim 1, the Applicant should refrain from using a backslash ("/") as in the phrases, "reading/writing" and "from/into". When used in this manner, a backslash can indicate *conjunction* (and), *disjunction* (or), or both (and/or). Therefore, the Applicant's usage of this symbol renders the claim unclear. Specifically, it is unclear, from the current language of Claim 1, whether information is both read *and* written, or whether information is read *or* written. It will be assumed, henceforth, that the Applicant intended the former. In particular, lines 3-4 of Claim 1 will be interpreted as:

> a reader/writer for reading information from said mobile storage device and for writing information into said mobile storage device,

37 C.F.R. § 1.75(a) requires claims "particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention or discovery". Appropriate correction of Claim 1 is thus required.

9. Lines 9-11 of Claim 1 state:

> a transmitting device for transmitting intermediate information preprocessed to said mobile storage device according to a request from said mobile storage device.

Clearly, this phrase is grammatically incorrect. Specifically, the placement of the word "preprocessed" is incorrect. It is assumed, herein, that the Applicant intended the word "preprocessed" to describe the "intermediate information". This section of Claim 1 could be more properly phrased as:

> a transmitting device for transmitting intermediate information, which has been preprocessed, to said mobile storage device according to a request from said mobile storage device.

or

> a transmitting device for transmitting preprocessed intermediate information to said mobile storage device according to a request from said mobile storage device.

Appropriate correction is required.

10. *The following is in regard to Claim 3.* Claim 3 contains the following language (lines 15-16):

> judging means for judging said fingerprint being identical to said template according to the plurality of results obtained in said matching means.

This phrase is poorly constructed and may incorrectly convey to the reader that said fingerprint is identical to said template, as a matter of course. The judging means determines whether of not the fingerprint is identical to the template. That is,

> judging means for judging whether or not said input fingerprint is identical to said template according to the plurality of results obtained in said matching means[2].

Appropriate correction is required.

11. On lines 10-11, Claim 3 states: "requesting means for requesting said fingerprint information ... *to* said reader/writer ..." (emphasis added). Typically, information is "requested from" a source such as the reader/writer, not "requested to" the source. It is, therefore, suggested that the Applicant change the word "to", where it is emphasized above in Claim 3, to the word "from". Appropriate correction is required.

12. *The following is in regard to Claim 5.* Claim 9-12 contains the following language (lines 15-16):

> retrieving means for retrieving a small image in the vicinity of a featuring point of said registered fingerprint by matching in the vicinity of coordinates of an image of said inputted fingerprint, *that the positional displacement of the coordinates having been corrected* ... [Emphasis added]

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2 Notice that the word "input" was added to avoid potential antecedent basis issues that could arise by claiming "said fingerprint" alone. Specifically, "said input fingerprint" clearly distinguishes the fingerprint from other "said fingerprints", such as the registered fingerprint (Claim 3, line 6).

The usage of the word "that" and the tense of the emphasized portion in the above excerpt are improper. This could be more properly expressed as:

> retrieving means for retrieving a small image in the vicinity of a featuring point of said registered fingerprint by matching in the vicinity of coordinates of an image of said inputted fingerprint, wherein the positional displacement of the coordinates has been corrected ...

Appropriate correction is required.

13. The language found on lines 13-14 of Claim 5 should also be corrected. This follows from the discussion of Claim 3 above.

Rejections Under 35 U.S.C. § 112(2)

14. The following is a quotation of the second paragraph of 35 U.S.C. § 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

15. Claim 3 is rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

16. *The following is in regard to Claim 3.* Claim 3 recites the limitation "the fingerprint" in line 9. There is insufficient antecedent basis for this limitation in the claim. Specifically, it is unclear whether "the fingerprint" refers to the registered fingerprint or the input fingerprint of Claim 3. It will be assumed that the Applicant intended to refer to both fingerprints – that is, "the fingerprints" – in line 9 of Claim 3. Because the displacement is measured between the core positions of both fingerprints, this assumption is legitimate.

Rejections Under 35 U.S.C. § 112(1)

17. The following is a quotation of the first paragraph of 35 U.S.C. § 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

18. Claim 4 is rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

19. The following limitation of Claim 4 (lines 4-5) finds no support in the Applicant's disclosure:

> ... determines a position where a direction of said normal vector varies from a predetermined value as a core position of said fingerprint.

This limitation can be interpreted in two ways. According to the first interpretation, the core is located at position where the direction of the normal vector deviates (varies) from or by some predetermined value, presumably a predetermined direction. According to the second interpretation, the core is located at a position where the direction of the normal vector varies (as opposed to being constant), wherein the determination of this position is based on a predetermined value. The first interpretation proceeds more naturally from the language of Claim 4 (the second interpretation, on the other hand, requires some abuse of the language), and conforms more to the essence of the Applicant's claimed invention than the second interpretation. Therefore, the first interpretation will be adopted in this document. Regardless of the interpretation, the Specification fails to provide sufficient support for this limitation.

20. Generally, according to the Applicant's disclosure, the location of the core is determined at a position where the normal vector "largely changes" (cf. Specification, page 24, ¶ 4). Regions of the fingerprint where the direction of the normal vector undergoes significant change correspond to areas in which ridge contours exhibit high curvature, and are indicative of where the core of the fingerprint may be. Indeed, the Applicant proposes locating the core at the position which exhibits a maximum curvature (cf. Specification, page 21, ¶ 4). Accordingly, several different paths[3] (cf. Specification, page 19, ¶ 3) are traced through a predefined region of the fingerprint (e.g., region **810**). The curvature is evaluated at discrete points (i.e., candidate points – cf. Specification, page 17, ¶ 4) along each of the paths. The maximum curvature encountered along each path is tabulated along with the corresponding candidate point. The set of these tabulated points whose associated curvatures meet or exceed a predetermined

3 Different paths are established essentially by setting the initial position, as in step **S710** of Applicant's Fig. 9.

threshold are then averaged (in terms of their position within the fingerprint image) to determine the position of the core (cf. Specification, page 21, last paragraph).

21. It should be clear from the preceding discussion that, while the normal vectors and the curvatures along the ridges are related (i.e., the angle between adjoining normal vectors influences, or is at least indicative of, the curvature of ridge contour near said normal vectors), the core position is *not* necessarily "a position where a direction of said normal vector varies from a predetermined value", but rather a position where the maximum curvature is greater than or equal to some predetermined threshold. Thus, the normal vectors are not compared against a predetermined value, in general. Indeed, the calculation of the curvature may not rely on normal vectors at all. According to the Applicant, the curvature may be calculated via any method (cf. Specification, page 21, sentence 1). One method proposed by the Applicant is to use the cosine of the angle between adjoining normal vectors. However, an abundance of other methods exist to calculate the curvature of contours, groups of contours, or vector fields. These methods typically do not involve any explicit analysis of normal vectors. Therefore, a definition of curvature that is directly dependant upon the aforesaid normal vectors is not an essential aspect of the Applicant's claimed invention. Instead, the normal vectors of the Applicant's invention serve primarily to trace paths through the fingerprint image (cf. Specification, page 19, ¶ 3).

Rejections Under 35 U.S.C. § 102(e)

22. The following is a quotation of the appropriate paragraphs of 35 U.S.C. § 102 that form the basis for the rejections under this section made in this Office action:

> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

23. Claims 1-2 are rejected under 35 U.S.C. § 102(e) as being anticipated by [Wiebe04] (L. Wiebe, *U.S. Patent 6,719,200: Checking of Right to Access*, 102(e) Date: August 1999).

24. *The following is in regard to Claim 1.* [Wiebe04] discloses a biometric authentication system (cf. [Wiebe04], Abstract) comprising:

(1.a.) A mobile storage device (e.g., a *portable data carrier* – cf. [Wiebe04] column 3, lines 27-40; or a *smart card* – cf. Fig. 1, reference number **1**).

(1.b.) A reader/writer (i.e., processing unit **2** shown in [Wiebe04] Fig. 1) for reading information from said mobile storage device (and for writing information into said mobile storage device (cf. [Wiebe04] column 10, lines 10-15).

The reader/writer (i.e., processing unit **2**) comprises[4]:

(1.b.1.) A biological information input device (i.e., sensor **8**) which inputs biological information.

(1.b.2.) Preprocessing means (e.g., processor **7**) for preprocessing the biological information input by said biological information input device (cf. [Wiebe04] column 8, lines 32-34).

(1.b.3.) A transmitting device (i.e., communication circuit **4**) for transmitting intermediate information, which has been preprocessed, to said mobile storage device according to a request from said mobile storage device (cf. [Wiebe04], column 9, lines 42-49).

The mobile storage unit (smart card **1**) comprises[3]:

(1.a.1.) A template of biological information (i.e., a template, stored in memory **6** (see [Wiebe04] Fig. 1), which consists of biometric reference data – cf. [Wiebe04] column 8, lines 20-27).

(1.a.2.) A "private key" (i.e., "sensitive information" – cf. [Wiebe04] column 3, lines 42-50 and column 1, lines 45-54) to be used for electronic authentication. The sensitive information stored on the smart card may include, though is clearly not limited to, a "key" which makes it possible to open a door or access authorized data, so-called digital certificates (cf. [Wiebe04] column 3, lines 42-50), or more conventional information, such as a personal identification code (PIN – cf. [Wiebe04] column 1, lines 50-54).

(1.a.3.) Comparing means (e.g., the processor **5**/memory **6** configuration depicted in [Wiebe04] Fig. 1) for comparing said intermediate (preprocessed) information with said template (cf. [Wiebe04] Fig. 1 and column 8, lines 28-32).

(1.a.4.) Requesting means for requesting another intermediate information from said reader/writer

4 Reference will be made generally to [Wiebe04] Fig. 1.

according to said comparing result. According to [Wiebe04] ([Wiebe04] column 8, last paragraph), if the quality of a fingerprint image is insufficient, the user is requested to correct the deficiencies in a suitable manner (e.g., by adjusting the condition of the finger and reapplying it to the sensor). Whatever means [Wiebe04] uses to accomplishes this user-request can be viewede as a "requesting means", in accordance with Claim 1.

(1.a.5.) Means for making said private key (i.e., sensitive information) available when said comparing result satisfies a predetermined condition. The sensitive information stored on the card is accessible only after it has been determined that the fingerprint presented to the processing unit **2** matches the template stored on the card (at least to within some predefined precision – cf. [Wiebe04] column 4, lines 30-35 and column 9, ¶ 4 to column 10, ¶ 1).

[Wiebe04] thus teaches a biometric authentication system comprising all elements of Claim 1.

25. *The following is in regard to Claim 2.* In the biometric authentication system of [Wiebe04][3]:

(2.a.) The biological information is fingerprint information (cf. [Wiebe04] column 5, last paragraph).

(2.b.) The preprocessing means in said reader/writer generates fingerprint image information necessary for a fingerprint identification as said intermediate information. The preprocessing essentially consists of using adaptive thresholding to binarize the input fingerprint image (cf. [Wiebe04] column 4, last paragraph and column 9, ¶ 1). Other conventional preprocessing operations include noise removal or morphological operations such as thinning. According to [Wiebe04], the purpose of the preprocessing procedures is to reduce the amount of information extracted from the input fingerprint, while maintaining a sufficient amount to make a safe comparison with the stored template (cf. [Wiebe04], column 4, lines 7-9 and column 5, ¶ 1).

(2.c.) The comparison means in said mobile storage device performs the fingerprint identification by processing said fingerprint information (i.e., the input fingerprint information). Specifically, a comparison is made, "onboard" the smart card **1**, between the stored template and a preprocessed fingerprint image which has been transferred from the processing unit **2** to the card (cf. [Wiebe04]

column 9, lines 46-49).

Rejections Under 35 U.S.C. § 103(a)

26. The following is a quotation of 35 U.S.C. § 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

27. Claims 3-4 are rejected under 35 U.S.C. § 103(a) as being unpatentable over [Wiebe04] in view of [Iwata94] (S. Iwata, *Japanese Patent Application Publication No. 06-301768 (Application No. 05-086477): Fingerprint Collation Device*, Publication Date: October 1994)[5], in further view of [Russo04] (A. Russo, *U.S. Patent 6,681,034: Method and System for Fingerprint Template Matching*, Filing Date: July 1999).

28. *The following is in regard to Claim 3.*. In the biometric authentication system of [Wiebe04][3]:

($3.a_{Wiebe.}$) The template includes:

1. Several small images (referred to interchangeably as *selected areas* – cf. [Wiebe04] column 9, ¶ 2 – or *partial areas* – cf. [Wiebe04] column 5, lines 13-15) of predetermined size (e.g., 48×48 pixels) and position.

The size and position of these selected areas are chosen so as to comprise as much individual-specific information as possible ([Wiebe04] column 9, lines 23-26). Clearly, these selected areas must be given coordinates to indicate their position within the image. Such coordinates could be considered "featuring points", in the sense that they are indicative of salient (individual-specific) features of the fingerprint. However, they would not *per se* satisfy the Applicant's definition of "featuring points", which are more akin to the minutiae of a fingerprint. These disparities are discussed below.

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5 Reference will be made solely to the machine-generated English translation of this publication.

($3.b_{Wiebe.}$) The comparison means includes:

1. A registered fingerprint. As discussed above, a fingerprint template, which presumably corresponds to the owner of the smart-card, is stored in advance (e.g., in memory **6**). The owner of card clearly represents a "registered" user of the card or of the facilities he/she intends to access via the card. Furthermore, the initial storage of the template can be regarded as a "registration" process. The template is, therefore, an image of a registered fingerprint.
2. Calculating means for correcting a positional displacement between said registered fingerprint and an input fingerprint that is newly input by using a *center* position of the fingerprint. This "corrective" process is discussed generally in [Wiebe04] column 9, ¶ 4, in conjunction with column 9, ¶ 2, sentence 2. One of the selected areas is chosen at a central location of the fingerprint image. When the smart-card receives the preprocessed fingerprint image from the processing unit **2** (cf. [Wiebe04] Fig. 1), it searches for a position where the central partial area of the template best overlaps a corresponding partial area of the input fingerprint information (cf. [Wiebe04] column 9, lines 55-58). The locations of the other partial areas are determine relative to this central area. Essentially, this process attempts – albeit somewhat crudely – to register or align the template image with the input fingerprint image, thereby, correcting any positional displacement that may exist between the two images.
3. Requesting means for requesting said fingerprint image information in the vicinity of said coordinates (i.e., the coordinates of the selected areas) from the reader/writer. After the verification process is initiated, the preprocessed input fingerprint image is sent (e.g., via some request/send protocol that presumably exists between the communication circuit **3** of the smart card and the communication circuit **4** of the processing unit) to the smart card, in its entirety (cf. [Wiebe04] column 9, lines 46-49). This image includes fingerprint image information in the vicinity of the

coordinates of the selected areas.

4. Matching means for matching said small images in the vicinity of said coordinates (partial images) and said fingerprint image information requested (cf. [Wiebe04], column 9, last paragraph, sentence 1).
5. Judging means for judging said fingerprint being identical to said template according to the plurality of results obtained in said matching means (cf. [Wiebe04] column 9, ¶ 5 through column 10, ¶ 1).

29. As discussed above, coordinates are inherently assigned to each of the partial areas in order to locate them within the image. The coordinates of the partial areas can themselves be considered "featuring points", in the sense that they are indicative of salient (individual-specific) features of the fingerprint. However, there is no explicit mention in [Wiebe04] that these coordinates are associated with the "featuring points" of the Applicant's definition (e.g., minutiae or the core of the fingerprint – cf. Applicant's Fig. 6). Therefore, [Wiebe04] does not expressly disclose that:

(3.a.) The template includes:

1. A plurality of coordinates of featuring points of a registered fingerprint in said template.
2. Small images in the vicinity of said coordinates (of the featuring points).

In addition, while [Wiebe04] perform a correction of positional displacement using a central partial area of the fingerprint, this central partial area may not necessarily coincide with the *core* of the fingerprint. That is, [Wiebe04] does not expressly disclose a:

(3.b.2.) Calculating means for calculating information for correcting a positional displacement between said registered fingerprint and an input fingerprint that is newly input by using a *core* position.

Lastly, [Wiebe04] does not expressly disclose:

(3.b.3.) Requesting means for requesting said fingerprint image information in the vicinity of said coordinates from said reader/writer according to said coordinates of said featuring point and said information for correcting a positional displacement.

30. [Iwata94] discloses a method for biometric authentication. As in [Wiebe04] and the Applicant's claimed invention, [Iwata94] authenticates (cf. [Iwata94] page 15, ¶ [0074]-[0075]) a fingerprint by determining the degree

to which a captured (cf. [Iwata94] Fig. 1 and ¶ [0031], sentence 2) fingerprint image (referred to as the *input fingerprint* in [Iwata94] – cf. [Iwata94] page 11, line 18) matches a previously stored template (i.e., a *registration fingerprint image* – cf. [Iwata94] page 11, line 18, or *registered aperture image* – cf. ¶ [0026] on page 9 and ¶ [0076] on page 15 of [Iwata94]). Like the Applicant's claimed invention, [Iwata94] aligns the input fingerprint image and the template using their respective core positions in order to facilitate subsequent matching procedures (cf. [Iwata94], page 8, ¶ [0026]). Specifically, the method of [Iwata94] comprises:

(3.a.) A template which includes:

1. A plurality of coordinates of featuring points (i.e., a *focus* or *foci* – cf. ¶ [0006] and [0009] on pages 6-7 of [Iwata94] and ¶ [0073]-[0074] on page 15) of a registered fingerprint in said template (i.e., the *registration fingerprint image* or *registered aperture image*). The foci include bifurcation points (branching points), ridge endpoints (endpoints), and singularities (cf. [Iwata94], page 12, ¶ [0052]). The foci of [Iwata94] are, therefore, equivalent to the "featuring points" of the Applicant.
2. Small images (i.e., *aperture images*[6] – cf. [Iwata94] Drawing 10) in the vicinity of said coordinates of the featuring points (cf. [Iwata94] page 7 ¶ [0009], page 8 ¶ [0026], page 10 ¶ [0037], and page 15 ¶ [0073]).

According to [Iwata94], the comparison (collation) between the input fingerprint image and the template (i.e., the *registration fingerprint image* or *registered aperture image*) comprises:

(3.b.1.) Comparison with a registered fingerprint (i.e., the aforesaid *registration fingerprint image*).

(3.b.2.) Calculating information for correcting a positional displacement between said registered fingerprint and an input fingerprint that is newly input by using a core position of the fingerprints (cf. [Iwata94] page 9 lines 32-45, page 10 lines 1-5, and page 12, ¶ [0053]). Specifically, [Iwata94] extracts a singular point (e.g., the core – cf. [Iwata94], page 12, line 48) from each fingerprint (cf. [Iwata94] ¶ [0035]). Then, using the extracted singular points, aligns (i.e., correct for positional displacement of) the input fingerprint image with respect to the template, or vice

6 These will be referred to interchangeably as apertures in this document.

versa (cf. [Iwata94] ¶ [0035]). The alignment can be achieved by shifting one of the images so that the singular points of both images coincide (i.e., the positions of the extracted singular points are brought "into agreement" – cf. [Iwata94] page 10, ¶ [0035] and page 15, ¶ [0081]). This process effectively shifts each of the apertures (of the image undergoing correction) by an amount equal to the positional displacement between the extracted singular points.

Once the images have been aligned, they are compared to determine the degree to which they match (cf. [Iwata94], ¶ [0035]). This process involves:

(3.b.4.) Matching said small images in the vicinity of said coordinates (apertures) and said fingerprint image information requested (i.e., fingerprint image information in the vicinity of said coordinates selected, or requested, in accordance to said coordinates of said featuring point and said information for correcting a positional displacement). In a manner similar to [Wiebe04] (cf. [Wiebe04] column 9, last paragraph), [Iwata94] compares (collates) apertures of the template (registered fingerprint image) with the preprocessed input fingerprint image (cf. [Iwata94], pages 15-16, ¶ [0081]-[0089]). Notice that for this comparison to work properly (or to make any sense) a comparison must made with corresponding regions (apertures) of the input fingerprint image. In other words, comparison must be made between small images in the vicinity of said coordinates (i.e., apertures of the template) and fingerprint image information in the vicinity of said coordinates selected in accordance to said coordinates of said featuring point (i.e., corresponding regions, or apertures of the input fingerprint). Furthermore, since the images are aligned prior to the collation process, the selection of these regions is based on an aligned input fingerprint image. Such regions thus incorporate information for correcting a positional displacement, and their selection can be said to inherently involve information for correcting a positional displacement.

(3.b.5.) Judging whether or not said input fingerprint is identical to said template according to the plurality of results obtained by the aforesaid collating of the fingerprint images. As stated above, [Iwata94] performs a comparison between each aperture of the template and the corresponding region in the input fingerprint image. If these match to within some predetermined threshold, the

input fingerprint is determined to be the same as the registered fingerprint (cf. [Iwata94], page 16, ¶ [0086]-[0088]).

31. [Wiebe04] and [Iwata94] clearly disclose similar authentication processes. [Wiebe04] further suggests the following modification of the biometric authentication system described above: "a reference point can be located in the verification to achieve a quicker comparison between the images, and the areas of the image that are selected to be matched can be selected on the basis of other criteria than those described above". The singular point or fingerprint core detected in [Iwata94] clearly constitutes such a reference point. Furthermore, selecting partial areas which are proximate to minutiae or singular points (i.e., foci or "featuring points") – as disclosed by [Iwata94] – provides a viable alternative to the selection process proposed in [Wiebe04][7].

32. Given this, it would have been obvious to one of ordinary skill in the art, at the time of the Applicant's claimed invention, to construct the template used in [Wiebe04] according to the teachings of [Iwata94], that is, to construct the template such that it includes small areas (e.g., aperture images, partial images, etc.) in the vicinity of extracted featuring points, such as minutiae or singular points. Minutiae are local features which can be extracted from every fingerprint. Collectively, their locations can uniquely identify the fingerprint from which they are extracted. By constructing sub-regions of the fingerprint which contain minutiae ("featuring points"), one focuses the authentication process on regions which can uniquely identify the fingerprint, thus obviating an inspection of the entire image.

33. It would have also been obvious to one of ordinary skill in the art, at the time of the Applicant's claimed invention, to align the fingerprint images (i.e., to calculate and correct a positional displacement between the images) by utilizing the method proposed in [Iwata94], as opposed to the simplistic method of [Wiebe04]. Any positional displacement that exists between the respective singular point positions – in particular, the core positions – of the input fingerprint and template would thus be corrected or eliminated; the advantage of this being that veracity of the subsequent matching process is improved (cf. [Iwata94], pages 8-9, *Technical Problem* and page 16, ¶ [0089]). The position of the core is a global feature of the fingerprint (cf. [Iwata94], ¶ [0050]) and is generally

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7 As noted above, [Wiebe04] broadly defines partial areas as being subsections of the fingerprint image whose size and position are chosen, *a priori*, so as to comprise as much individual-specific information as possible. It should be apparent that the aperture images of [Iwata94] fall within the scope of this definition. As such, the aperture images of [Iwata94] and [Wiebe04] are clearly interchangeable.

located at its center. As such, the core provides an ideal reference point, whereby the displacement between two fingerprint images can be evaluated.

34. Recall that both [Wiebe04] (cf. [Wiebe04], column 9, lines 59-60) and [Iwata94] (cf. [Iwata94], pages 15-16, ¶ [0081]-[0089]) determine whether the template and input fingerprint images match by comparing sub-regions of the images (e.g., partial images in [Wiebe04] and apertures in [Iwata94]). As stated above, in [Wiebe04], the preprocessed input fingerprint image is sent to the smart card in its entirety. The transferred image would include, *inter alia*, "said fingerprint image information in the vicinity of said coordinates" (i.e., the partial images or aperture images of the input fingerprint). Some means must be present in the smart card to initiate and then facilitate this transfer. Such means may be considered a "requesting means". However, because the fingerprint image is transferred in its entirety, requests issued by the smart card of [Wiebe04] would not be made "according to said coordinates of said featuring point and said information for correcting a positional displacement".

35. [Russo04] discloses a biometric authentication system which includes a smart card ([Russo04], Fig. 1, reference number **100**) and processing unit ([Russo04], Fig. 1, *smart-card reader* **110**) of similar construction to those of [Wiebe04]. Like [Wiebe04] and [Iwata94], [Russo04] performs authentication by comparing subregions (i.e., *chunks* – cf. [Russo04], Abstract) of a stored template fingerprint (i.e. a *reference fingerprint template* – cf. [Russo04], column 2, lines 53-57 and column 4, ¶ 5) with corresponding subregions of an input fingerprint image (i.e., a *measured fingerprint template* – cf. [Russo04], column 2, lines 53-57 and column 6, ¶ 1). This comparison is performed on a "chunk-by-chunk" basis (cf. [Russo04], column 14, lines 10-56), wherein measured chunks are sequentially loaded from the smart-card reader (cf. [Russo04], column 14, ¶ 3) and compared with the corresponding reference chunks (cf. [Russo04], column 14, ¶ 1-2). The chunks may be requested according a positional parameter, (x_j,y_j), which denotes the coordinates of a minutia j (cf. [Russo04], column 12, lines 48-55 and column 14, lines 57-65, and column 7, lines 31-34). In other words, chunks are requested from the reader/writer according to the coordinates of a "featuring point".

36. [Wiebe04], [Iwata94], and [Russo04] all disclose systems that are similar in both form and function. [Russo04] provides an alternative method of transferring (requesting/sending) the input fingerprint information from a reader/writer to a smart card. In [Russo04] sub-regions of the input fingerprint image are transferred individually, instead of transferring the entire fingerprint image, as done in [Wiebe04]. This is clearly advantageous in situations

where the bandwidth of the communication channel between the reader/writer and smart is limited. Since the authentication processes of [Wiebe04], [Iwata94], and [Russo04] are focused solely on important sub-regions of the fingerprint image, all other regions of the input fingerprint are completely redundant. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the Applicant's claimed invention, to transfer the preprocessed input fingerprint image of [Wiebe04], on a "chunk-by-chunk" basis, in accordance with the teachings of [Russo04]. As a result, requests would be made "according to said coordinates of said featuring point".

37. As mentioned above, [Iwata94] teaches aligning the template and input fingerprint images prior to the matching process. Therefore, in the proposed combination of [Wiebe04], [Iwata94], and [Russo04], the input fingerprint image would be aligned with respect to the template image, and, as a result, any positional displacement that may exist between the two images is alleviated. This process effectively shifts each of the sub-regions ("small images") by an amount equal to the positional displacement between the images (which again is measured as the displacement of the respective core positions). Each sub-regions ("small image") thus incorporates "information for correcting a positional displacement". Consequently, the proposed combination of [Wiebe04], [Iwata94], and [Russo04] comprises:

> (3.b.3.) Requesting means for requesting said fingerprint image information in the vicinity of said coordinates from said reader/writer according to said coordinates of said featuring point and said information for correcting a positional displacement.

The biometric authentication system, obtained via the proposed combination of [Wiebe04], [Iwata94], and [Russo04], therefore satisfies all limitations of Claim 3.

38. *The following is in regard to Claim 4.* Core detection in [Iwata94] is accomplished by "[retrieving] a normal vector of a plurality of ridges sequentially, and [determining] a position where a direction of said normal varies from a predetermined value" (cf. [Iwata94], pages 12-13, ¶ [0052]-[0059], Drawing 8). According to [Iwata94], the core located at a position in the fingerprint where ridge contours attain their maximum curvature (cf. [Iwata94], page 12, ¶ [0053]). An abundance of prior art techniques exist for evaluating the curvature of contours, groups of contours, or vector fields, many of which utilize fields of normal vectors. [Iwata94], for example, determines the curvature of ridge contours by evaluating their direction within each of the aperture images (cf.

[Iwata94], ¶ [0055]). The local direction of the contour is defined in terms of its normal and tangent vectors within the aperture image (cf. [Iwata94], ¶ [0056] and [0059]). The singular point (e.g., the core of the fingerprint) is extracted based on the direction code of each of the aforesaid aperture images (cf. [Iwata94], page 10, ¶ [0033] and page 14, ¶ [0067]). Direction codes are predetermined (cf. [Iwata94], page 13, lines 39-41and ¶ [0063]).

39. Claim 5 is rejected under 35 U.S.C. § 103(a) as being unpatentable over [Wiebe04] in view of [Driscoll91] (E. Driscoll et al., *U.S. Patent 5,067,162: Method and Apparatus for Verifying Identity Using Image Correlation*, Filing Date: June 1986).

40. *The following is in regard to Claim 5.* As discussed above, the biometric authentication system of [Wiebe04] comprises a comparing means in a smart card, wherein:

(5.$a_{Wiebe.}$) A positional displacement between said registered fingerprint and an input fingerprint that is newly input is corrected by using a center position of the fingerprint. See item (3.b_{Wiebe}.2.) above. Essentially, this "corrective" process attempts to register or align the template image with the input fingerprint image, thereby, mitigating any positional displacement that may exist between the two images. This is essentially a correlative process, wherein the sum of matching pixels ([Wiebe04] column 9, lines 51-54) represents the correlation between the input fingerprint image and the template.

The comparing means also comprises:

(5.c.) Judging means for judging whether or not said fingerprint image is identical to said template according to the number of matched said small images (cf. [Wiebe04] column 9, ¶ 5 – column 10, ¶ 1).

It should be clear from the discussion above with respect to Claim 3 that the comparing means further includes:

(5.$b_{Weibe.}$) Retrieving means for retrieving a small images (i.e., partial images) of said registered fingerprint.

However, as mentioned above, the small images of [Wiebe04] are not necessarily located in the vicinity of a featuring point. Furthermore, the positional displacement of "coordinates of an image" may not actually be corrected

in [Wiebe04]. Instead, [Wiebe04] establishes a position of reference within the input fingerprint image by searching for a region of the image that matches a central partial region of the template (cf. [Wiebe04] column 9, lines 49-60). While this may eliminate, or at least mitigate, the effect of any positional displacement between the images, the actual relative positions of the template and input fingerprint images (and their associated partial images) may remain unchanged. Therefore, [Wiebe04] fails to teach:

(5.b.) Retrieving means for retrieving a small images in the vicinity of a featuring point of said registered fingerprint by matching in the vicinity of coordinates of an image of said inputted fingerprint, wherein the positional displacement of the coordinates has been corrected.

Finally, although the "corrective process" of [Wiebe04] is correlative, it does not directly involve: "forming images having specific luminance distributions in the peripheries of individual featuring points with regard to the input fingerprint and the registered fingerprint".

41. [Driscoll91] discloses a biometric authentication system, which, like [Wiebe04], includes a smart card ([Driscoll91], Fig. 6, smart card **78**) and reader/writer (i.e., [Driscoll91], Fig. 5, fingerprint verification terminal **10**). Also, like [Wiebe04], [Driscoll91] compares small, distinctive sub-regions (i.e., *reference sections* – cf. [Driscoll91], column 2 line 67 to column 3 line 2, column 3 lines 54-58, and Figs. 8, 11, 13, and 15) of the template image with corresponding sub-regions of the input fingerprint (verify fingerprint – cf. [Driscoll91], column 5, lines 39-40) image (cf. [Driscoll91] column 17, line 58 to column 18, line 7). [Driscoll91] goes further, and constructs these reference sections so as to include featuring points (e.g., minutiae such as bifurcation points – cf. [Driscoll91] column 13, lines 22-27 and Fig. 11). Furthermore, [Driscoll91] determines the amount of translational displacement and uses this information to correct any misalignment between the template and input fingerprint images (cf. [Driscoll91], column 5, lines 44-67). Translation correction is specifically performed on the reference sections of the input fingerprint image (cf. [Driscoll91] column 5, lines 58-62). Thus, the biometric authentication system of [Driscoll91]:

(5.b.) Retrieves a small image (e.g., reference sections) in the vicinity of a featuring point (e.g., minutia, such as bifurcations) of said registered fingerprint (i.e., the template) by matching in the vicinity of coordinates of an image of said inputted fingerprint (i.e., the verify fingerprint image), wherein

the positional displacement of the coordinates has been corrected.

42. The translational displacement is determined by a correlation operation, wherein a *search region* is searched in order to find a reference section which matches the primary reference section of the template (cf. [Driscoll91] column 16, lines 39-49). The subsequent rotational correction (cf. [Driscoll91], column 17, ¶ 2) and the correction for "non-rigid" (e.g., swelling/shrinking – cf. [Driscoll91], column 16, lines 65-68) displacements (both corrections also being "positional displacement" corrections) also rely on these sub-regions of the image. The reference sections belonging to the template and verify fingerprint images, as well as the search region, all represent "images having specific luminance distributions"[8]. Furthermore, as discussed above, the reference sections are constructed about the featuring points (i.e., they are "in the peripheries of individual featuring points" – cf. [Driscoll91] Fig 11; notice, in Fig. 11, that the reference section **94** is constructed about a bifurcation). Search regions are, in turn, constructed about reference sections (cf. [Driscoll91], Fig. 15; notice, in Fig. 15, that search regions **112** and **116** are constructed about their respective reference sections). These regions are, therefore, also "in the peripheries of individual featuring points". In light of these observations, it should be apparent that [Driscoll91] teaches:

(5.a.) Calculating information for correcting a positional displacement between a registered fingerprint in said template and an input fingerprint that is newly input (i.e., the verify fingerprint image) by forming images (e.g., search regions and/or reference sections) having specific luminance distributions in the peripheries of individual featuring points with regard to the input fingerprint and the registered fingerprint, and by correlating said images therebetween.

43. [Driscoll91] also teaches:

(5.c.) Judging means for judging whether or not said fingerprint image is identical to said template according to the number of matched said small images (cf. [Driscoll91], column 6, ¶ 1 and

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8 Any image, and hence any region of an image, is a distribution of luminance (assuming grayscale imagery). For an image or image region, the luminance is known at each discrete location of the domain over which the image or image region is defined. Therefore, in terms of specificity, an image, or any region thereof, is as specific a distribution of luminance as one can construct.

The notion of specificity adopted here falls within the broad scope of the Applicant's "definition" of the word "specific". The Applicant fails to elucidate the specificity of his/her own "distributions of luminance", aside from providing a rather cryptic illustration in Fig. 29. It seems – albeit with some imagination – that the distributions illustrated in Fig. 19 are actually circular sub-regions of a fingerprint image, such as the one illustrated in Fig. 6. Taking this into account, it is believed that the Examiner's proposed interpretation of "specific distributions of luminance" is proper.

column 17, ¶ 4, to column 18, ¶ 1).

44. The systems of [Wiebe04] and [Driscoll91] are very similar, in both form and function. [Driscoll91], however, discloses, in greater detail, a verification process which is generally more robust that of [Wiebe04]. [Driscoll91] inherits several of the advantages of [Wiebe04], by virtue of the similarity of the two systems. However, [Driscoll91] provides a more comprehensive compensation for positional misalignment than [Wiebe04], compensating for not only translational displacement, but for rotational misalignments and "non-rigid" deformations as well. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the Applicant's claimed invention, to utilize the verification process (a "comparing means" is merely a physical realization thereof) of [Driscoll91] in the biometric authentication system of [Wiebe04], as opposed to the verification process of [Wiebe04]. The resulting biometric authentication system would comprise all elements set forth in Claim 5.

Citation of Relevant Prior Art

45. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

46. Biometric authentication systems which use a smart card:

[Yamada99] K. Yamada, *Japanese Patent Application Publication No. 11-143833 (Application No. 09-313390): User Confirmation System and IC Card by Biological Data and Storage Medium*, Machine-Generated English Translation, Publication Date: May 1999.

[Meister04] G. Meister et al., *U.S. Patent 6,798,334: Method and Device for Verifying a Biometric Characteristic*, 102(e) Date: September 1999.

[Walfridsson04] K. Walfridsson, *U.S. Patent Application Publication 2004/0052405A1: Biometric Identity Check*, PCT Filing Date: February 2001.

47. Methods for detecting the core of a fingerprint via the *Poincaré index*. The Poincaré index ([Hong98]) for any given point in a vector field is computed by summing the orientation difference between successive elements along a closed path around that point. As such, the Poincaré index provides an implicit measure of the curvature around a point of interest. The singular regions of the vector field that represent the ridge (or valley) pattern of the fingerprint can be easily detected since singularities corresponding to loops, whorls, and deltas assume a Poincaré index value of π, 2π, and $-\pi$ (or ½, 1, and –½, depending on the implementation), respectively. [Bazen01] avoid the expensive line integral of this approach by invoking Green's Theorem which states that a line integral around any point in a vector field can be replaced by a surface integral of the vector field's curl.

[Hong98] L. Hong, *Automatic Personal Identification Using Fingerprints*, Ph.D. Thesis, Michigan State University, pp. 147-166, June 1998.

[Bazen01] A.M. Bazen and S.H. Gerez, *Extraction of Singular Points from Directional Fields of Fingerprints*, Mobile Communications in Perspective, Annual CTIT Workshop, February 2001.

48. [Hsu00] discloses a correlation-based fingerprint verification system, wherein several reference patches of a template and measured fingerprint are correlated. The system preprocesses these images and compensates for translational and positional misalignment.

[Hsu00] S. Hsu et al., *U.S. Patent 6,134,340: Fingerprint Feature Correlator*. Filing Date: December 1997.

49. The following references locate the singularities (including the core) of a fingerprint by locally examining the ridge directional field. In particular, [Hara91], [Hsiao99], [Bergenek01], and [Kamei99] locate singularities at regions where the directional field indicates high curvature in the associated ridge-line pattern. [Ueberreiter99], on the other hand, look for points in the directional field which do not have well-defined directionality (e.g. points of high curvature).

[Setlack01] D. Setlak et al., *U.S. Patent 6,181,807: Methods and Related Apparatus for*

Fingerprint Indexing and Searching. Filing Date: December 1999.

[Hsu92] W. Hsu et al., *U.S. Patent 5,140,642: Method and Device for Allocating Core Points of Finger Prints*. Filing Date: April 1991.

[Sato99] A. Sato, *U.S. Patent 6,002,784: Apparatus and Method for Detecting Features of a Fingerprint Based on a Set of Inner Products Corresponding to a Directional Distribution of Ridges*. Filing Date: October 1996.

[Ueberreiter99] B. Ueberreiter et al., *U.S. Patent 5,920,641: Method for Reconstructing Linear Structures Present in Raster Form*. 102(e) Date: March 1997.

[Kamei99] T. Kamei, *U.S. Patent 5,974,163: Fingerprint Classification System*. Filing Date: December 1996.

[Hara91] M. Hara, *U.S. Patent 5,040,224: Fingerprint Processing System Capable Of Detecting A Core Of A Fingerprint Image By Statistically Processing Parameters*. Filing Date: April 1989.

[Hsiao99] P. Hsiao et al., *U.S. Patent 5,915,035: Method for Extracting High-Level Features for Fingerprint Recognition*. Filing Date: January 1997.

[Bergenek01] J. Bergenek et al., *U.S. Patent 6,241,288: Fingerprint Identification/Verification System*. Filing Date: August 1998.

[Bergenek01] also discloses several other relevant features, such as preprocessing an image through binarization and thinning, evaluating sub-regions of the image, and image alignment. The correlation procedure utilized by [Bergenek01] is also similar to the Applicant's (cf. page 36 of the Applicant's Specification and [Bergenek01] column 14, ¶ 1 to column 15, ¶ 3). Like the Applicant, [Bergenek01] evaluates the additive sum of a pixel-by-pixel XOR operation for each sub-region within a given window of the input fingerprint image. The sub-region exhibiting the greatest sum is determined to be the region of the input fingerprint image which corresponds to the central region of the template. Based

on this, the relative displacement of the input fingerprint image can be determined and corrected.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Siangchin whose telephone number is (703)305-7569. The examiner can normally be reached on 9:00am - 5:30pm, Monday - Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on (703)308-6604. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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